ENERGY ENGINEERING ANALYSIS PROGRAM

Letterkenny Army Depot
Pennsylvania

DISTRIBUTION STATEMENT A
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EXECUTIVE SUMMARY

REVISION ONE

1983

FINAL

DTIC QUALITY INSPECTED 2

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Contract No. DACA 65-80-C-0003

NORFOLK DISTRICT

CORPS OF ENGINEERS

REYNOLDS, SMITH AND HILLS
Architects-Engineers-Planners, Incorporated

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
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ENERGY ENGINEERING ANALYSIS

FORT DEVENS

SENECA ARMY DEPOT

LETTERKENNY ARMY DEPOT

CONTRACT NO. DACA65-80-C-0003

EXECUTIVE SUMMARY

LETTERKENNY ARMY DEPOT

PENNSYLVANIA

ORIGINAL ISSUE FEBRUARY 1982

REVISED SEPTEMBER 1983

Reynolds, Smith and Hills

Architects-Engineers-Planners,

Incorporated

Final Submittal

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Original Issue (2/82)

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INTRODUCTION

In February 1980, the Norfolk District Corpos of Engineers initiated Contract No. DACA65-80-C-0003 with Reynolds, Smith and Hills of Jacksonville, Florida. This contract called for the performance of Energy Engineering Analysis Programs of three U.S. Army installations: Fort Devens, Massachusetts; Letterkenny Army Depot, Pennsylvania; and Seneca Army Depot, New York. The objective of these Programs was the identification, evaluation, and development of programming documents for energy conservation projects which meet the criteria of the Army's Energy Conservation Investment Program (ECIP).

At Letterkenny Army Depot (LEAD) the initial work under this contract called for the following studies:

1. Increment A - Energy Conservation Investigations for Buildings and Processes
2. Increment B - Energy Conservation Investigations for Utilities and Energy Distribution Systems
3. Increment C - Investigation of Renewable Energy Projects
4. Increment D (cogeneration only) - Investigation of cogeneration and solid waste plants.

Increment A & B studies were performed in three phases. The first phase consisted of site surveys to inspect the major energy consuming buildings and systems, and collect data required for the identification and evaluation of potential ECIP projects. The detailed evaluation of the potential projects took place in the second phase and the development of the necessary documents in the third phase. Only the first phase, a preliminary assessment of economic feasibility, was authorized for Increments C & D.

Since the original contract issue, several additional investigations were funded. In August 1980, the contract was expanded to include investigation of central boiler plant projects (Increment E). In May 1981, the contract was expanded to include development of projects identified in Increments A and B that did not qualify under ECIP criteria (Increment G). The original issue of the Executive Summary (February 1982) summarized the above investigations and was included on pages 1 through 27 of this document.

In September 1982, the contract was extended to include investigation of Facilities Engineer conservation measures (Increment F). The revised Executive Summary (September 1983) summarizes the results of Increment F starting on page 28 of this Document. In addition, the discussion on fuel consumption and cost (pages 2 through 12) were updated with current information when available.

original 2/82
revised 9/83

BASELINE DATA

1. Description of the Installation

Letterkenny Army Depot (LEAD) is located in the Cumberland Valley approximately five miles north of Chambersburg and eight miles southwest of Shippenburg in south-central Pennsylvania. The depot, with a perimeter of 24 miles, covers approximately 19,511 acres. The depot has 225 miles of roads, 54 miles of railroads, 85 miles of electrical distribution lines, and four miles of fire alarm system lines. There are 94 miles of water, sewer, and steam lines.

The facility is primarily industrial in nature. The daytime population is principally civilian personnel who work in the various maintenance, receiving, packaging, storage and supporting facilities. There is no troop billeting and only a limited amount of family housing on the Post.

2. Energy Consumption

Primary energy sources for building use at LEAD are electricity and fuel oil. There is no natural gas supply. These energy sources are used primarily for space conditioning, process loads, dehumidified warehousing, building ventilation in process areas, and lighting. In FY 79 fuel oil accounted for 46% of the total building energy use at LEAD. This was the first year that fuel oil accounted for less energy consumption than electricity and was the direct result of energy conservation measures taken at LEAD over the past few years. These measures will be discussed later in this report.

Over the period of 1975 through 1979 the consumption of electricity at LEAD has increased at a steady rate, while the consumption of fuel oil has dropped substantially; however, fuel oil consumption has again risen (See Figure No. 1). The increase in electrical consumption from FY 75 through FY 79 was 11.5%, but it has shown a slight decrease since FY 79.

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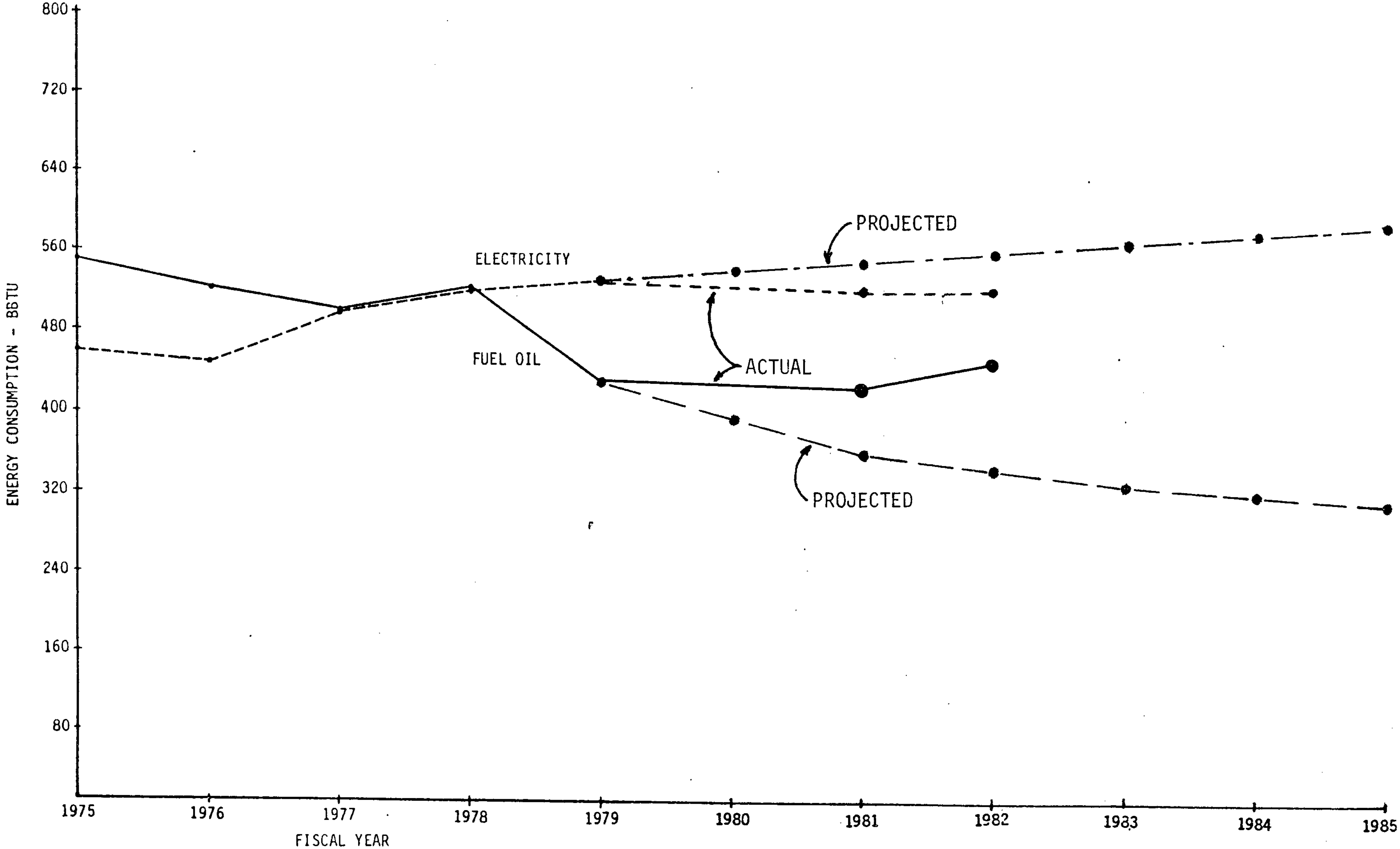

LETTERKENNY ARMY DEPOT
TOTAL ENERGY CONSUMPTION

FIGURE NO. 1

The combined energy consumption of the two energy sources dropped by 7% from FY 75 to FY 79, but only a 5.6% decrease from FY 75 to FY 82.

In spite of this reduction in energy use, energy costs have escalated such that LEAD spent 7.4% more in FY 79 for energy than it did in FY 75 (See Figure No. 2). Energy costs have increased significantly since FY 79, but not as much as projected because of lower fuel oil costs than expected.

2.1 Electricity

Electricity for LEAD is supplied by West Penn Power Company, which is part of the Allegheny Power System. West Penn Power is almost entirely coal-fired and, as such, until FY 79, had one of the lowest and most stable electric rates in the country. The present cost of electricity to LEAD is $.0216 per kilowatt hour for energy and fuel adjustment and $6.162 per kilowatt for demand. This provides an average cost of electricity of $.038 per kilowatt-hour.

The monthly consumption and peak demand for electricity at LEAD does not change significantly over the course of a year principally because the electric load is not weather dependent (See Figure No. 3). As would be expected, the heaviest electric usage occurs when the daytime work force is present; however, there is a significant base electrical consumption (See Figure Nos. 4 and 5). This base electrical load is comprised primarily of boiler plant auxiliaries, dehumidification systems, computers, and space conditioning systems for the computer facilities.

The electrical Distribution System at Letterkenney Army Depot consists of eight overhead 7200 volt 3 phase circuits from a government owned switching station located at the Southeast corner of the facility. Adjacent to this switching station is located a West Penn Power Company (formerly Potomac Edison Power Company) substation containing two 500 KVA, 34.5 - 7.2 KV transformers and one 10,000 KVA, 69-34.5 KV transformer. This last transformer is connected to a 69 KV grid.

The 700 volt circuit conductors are 1/0 copper and 4/0 aluminium, which would be capable of handling 2500 to 3000 KVA on a particular circuit. This would indicate that each circuit is operating at well less than its potential, since the total facility has a maximum demand of between 8600 KW in 9600 KW throughout the year.

The majority of utilization transformers at the individual buildings are single phase pole mounted units between 25 and 75 KVA. Three phase transformers are used at the larger buildings and at the process areas.

The layout of the system has both flexibility and future load growth, while the major electrical loads are reasonably close to the substation which will keep line losses at a minimum.

A detailed analysis of the Electrical Distribution was not done because it was felt that the system by itself was not wasteful. Increasing the voltage level to 15 KV would require enormous expense to change out wiring, transformers, insulators, switching equipment and the main substation. This cost could only be justified by load capacity increase for the facility, not by any possible energy savings.

2.2 Fuel Oil

Fuel oil for LEAD is supplied by various contractors. The facility uses No. 2, No. 5 and No. 6 fuel oils. The present costs for the three fuel oils are: No. 2 - $1.12 per gallon ($7.81 per MBtu), No. 5 - $.940 per gallon ($5.49 per MBtu), and No. 6 - $.920 per gallon ($4.56 per MBtu).

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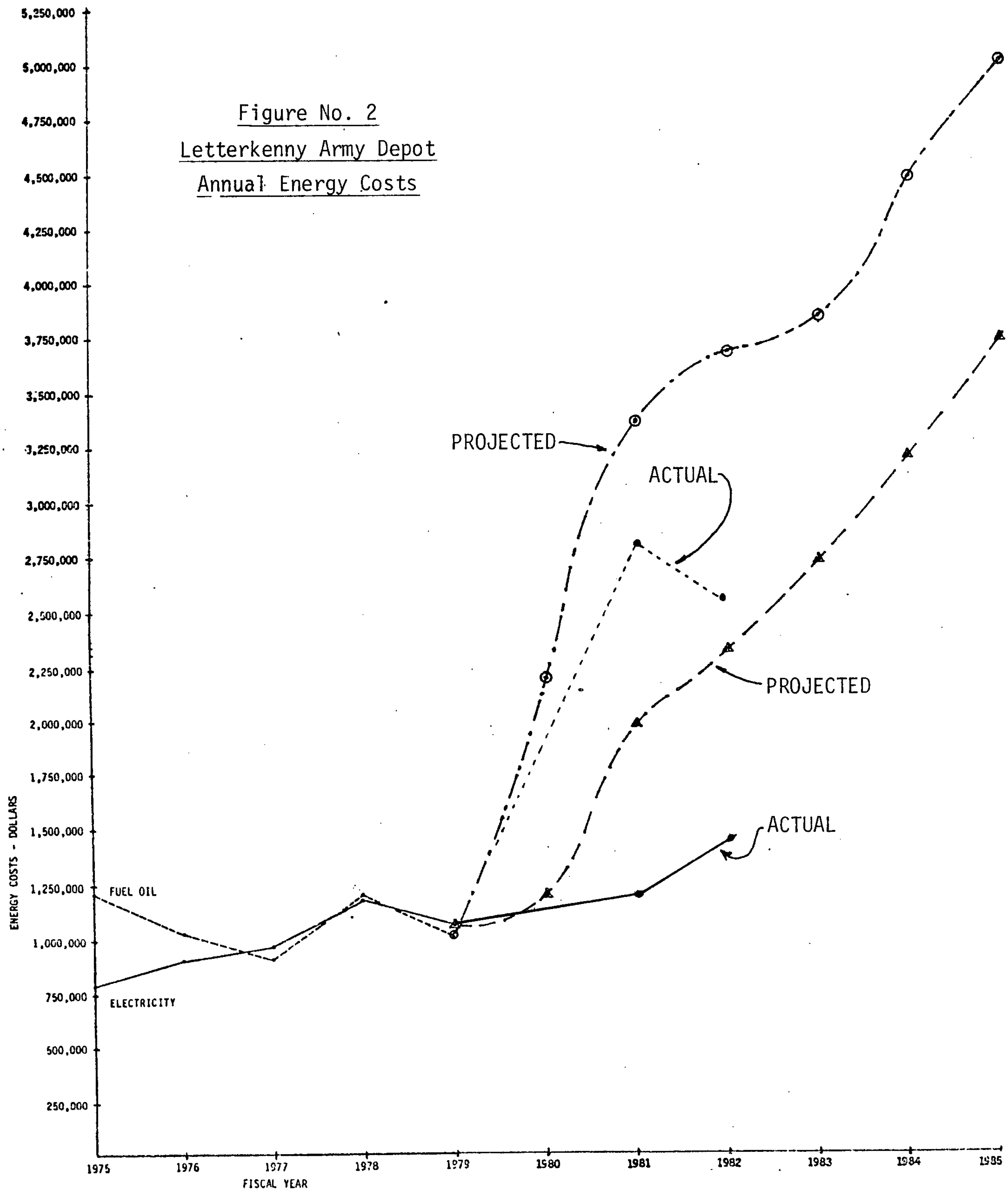

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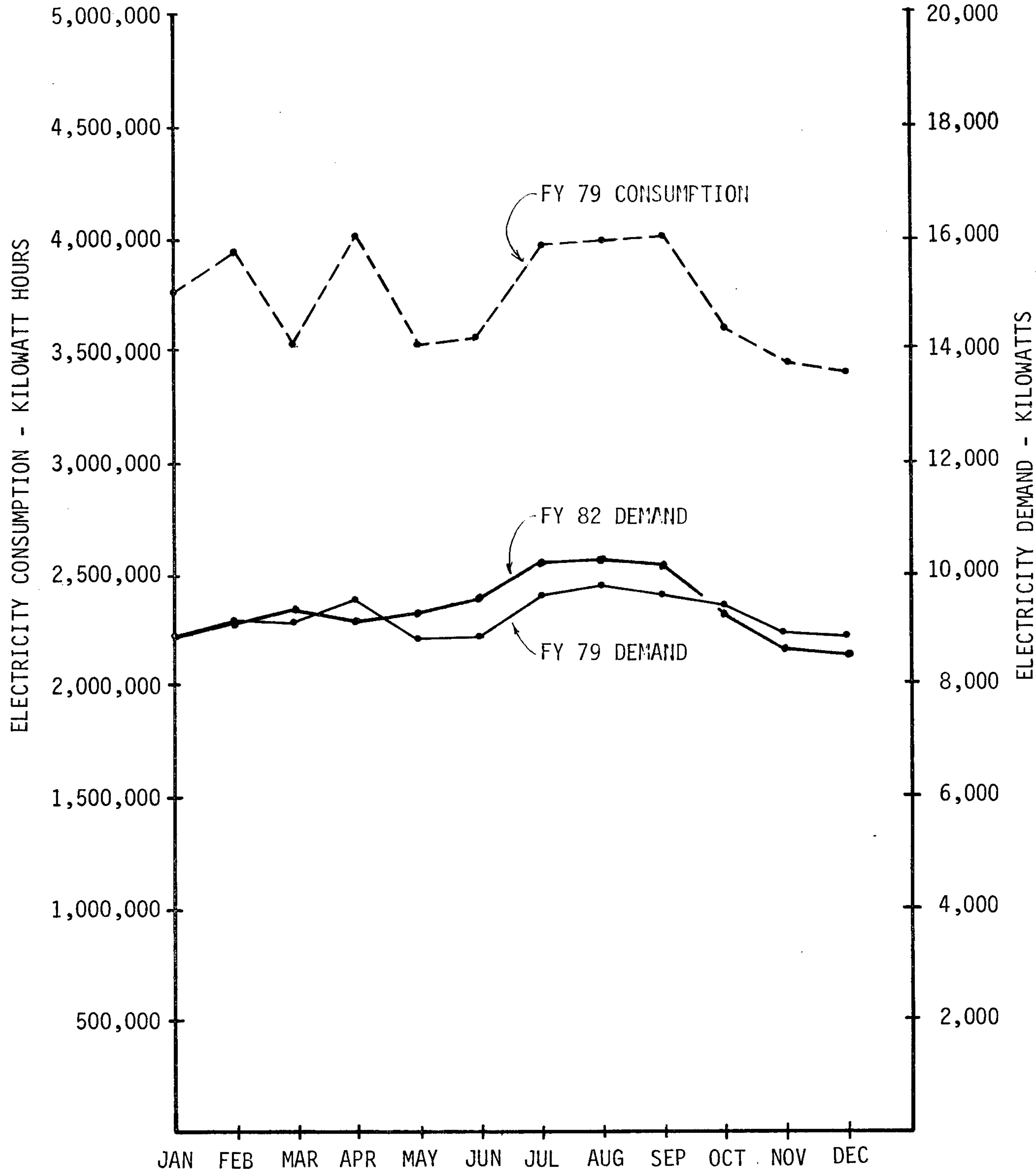
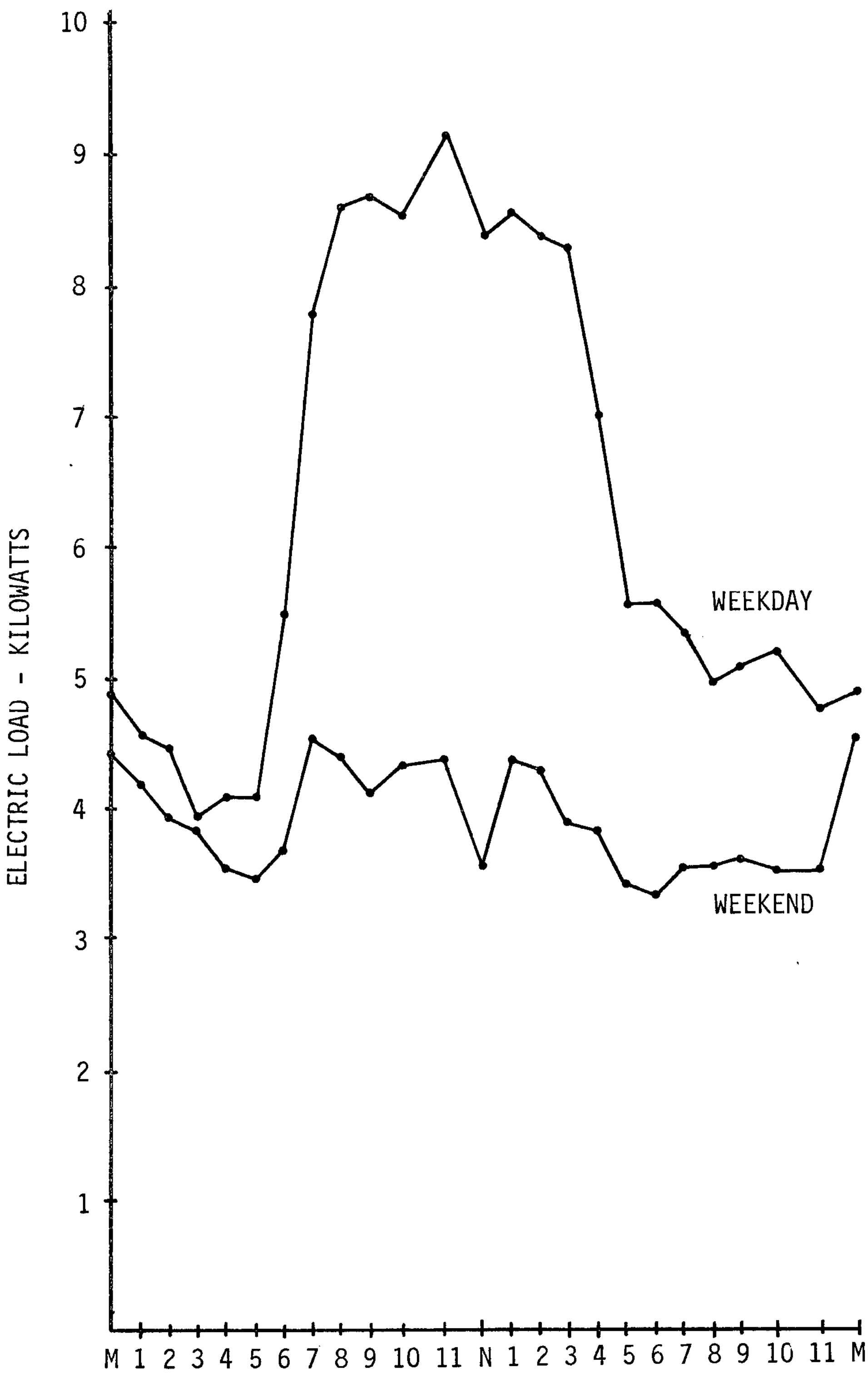


LETTERKENNY ARMY DEPOT

MONTHLY ELECTRIC
CONSUMPTION AND DEMAND

FIGURE NO. 3

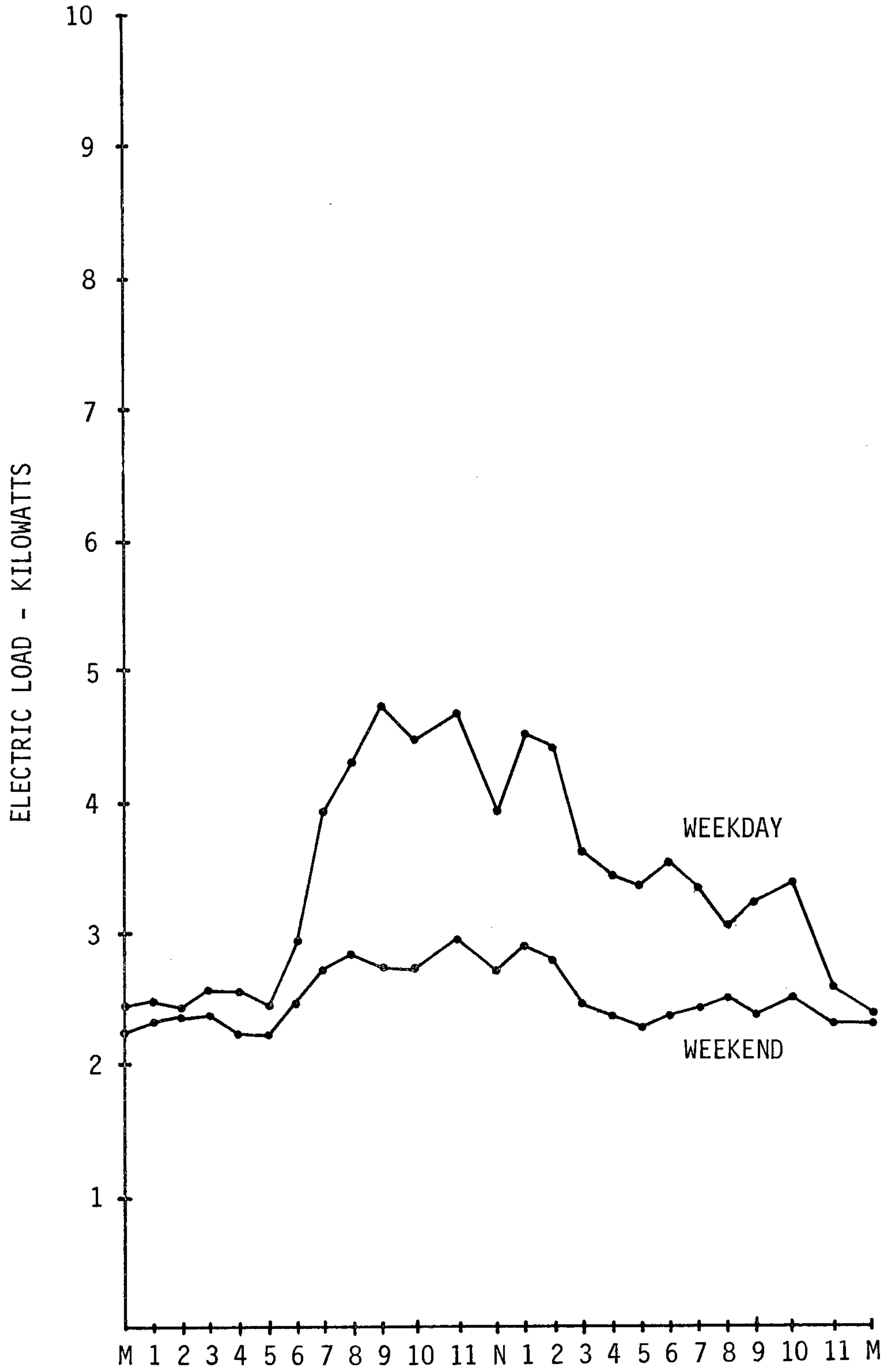


LETTERKENNY ARMY DEPOT

DAILY ELECTRIC LOAD PROFILES

SEPTEMBER

FIGURE NO. 4



LETTERKENNY ARMY DEPOT

DAILY ELECTRIC LOAD PROFILES

FEBRUARY

FIGURE NO. 5

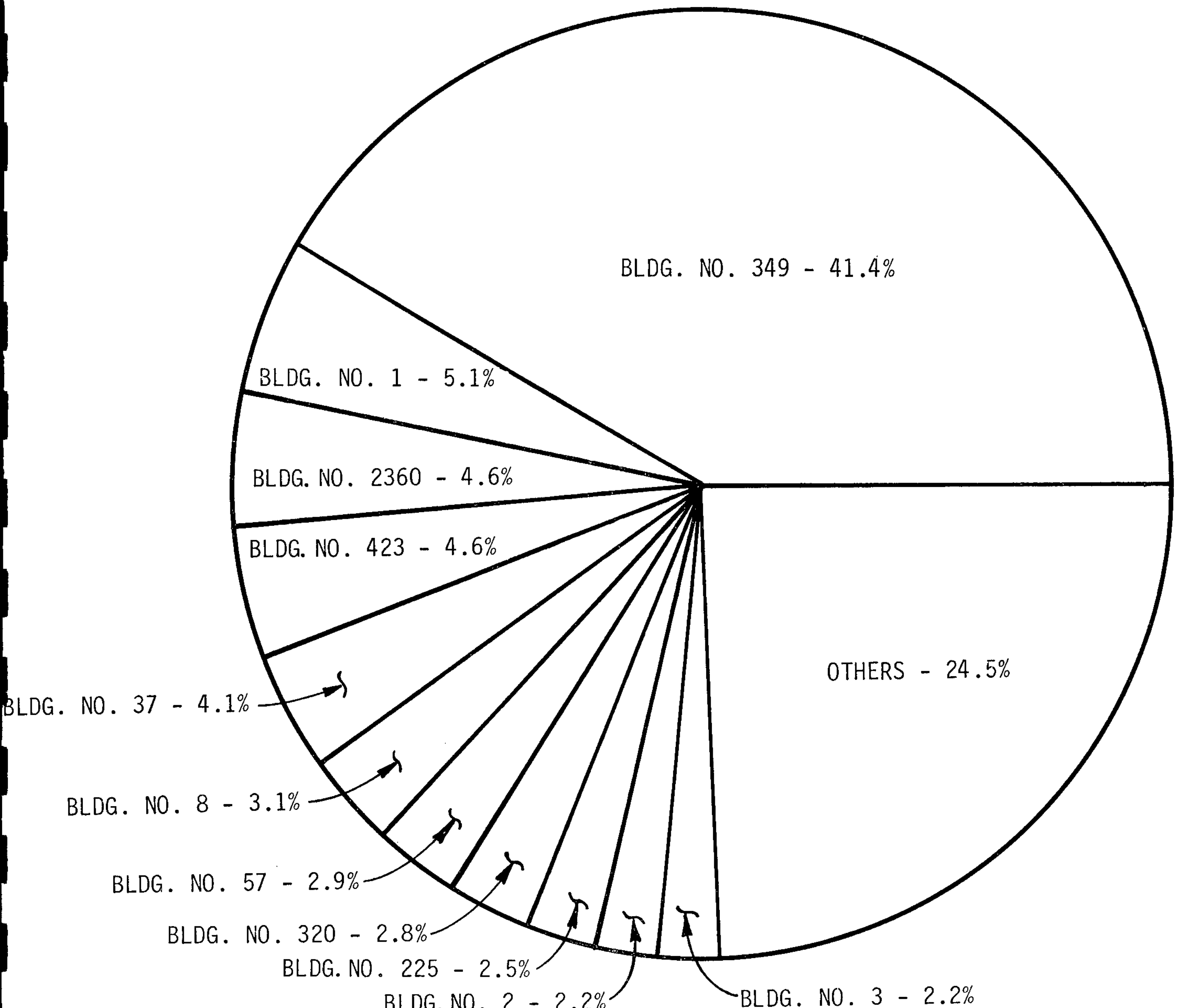
No. 2 fuel oil is used for space heating and domestic hot water production in the family housing units and in numerous small buildings which are served by their own boiler plant. It also is used in small hot water boilers in some larger buildings which are heated from central steam systems. No. 5 fuel oil is used for space heating and process steam in all the central heating plants except Building No. 349. No. 6 fuel oil is used exclusively in central heating plant Building No. 349 which serves Building Nos. 350 and 370. The central heating plant in Building No. 349 is, by far, the single largest fuel oil user at LEAD. The other central heating plants combined do not consume as much fuel as Building No. 349 (See Figure No. 6).

From 1975 to 1979 the consumption of No. 2 fuel oil at LEAD has not changed significantly - a 2% reduction. Likewise, the consumption of No. 6 fuel oil has not changed significantly, a 1.7% increase over the same period. The consumption of No. 5 fuel oil has changed dramatically from 1975 to 1979 as a direct result of a comprehensive energy conservation program implemented by LEAD personnel. The program consisted of wall and/or ceiling insulation, outside air temperature shut-offs on heating systems, and night and weekend temperature setback on many of the buildings supplied by central heating plants using No. 5 fuel oil. Further discussion of these measures is presented in the building descriptions contained in the Appendix of the Interim Report. The result of the efforts by LEAD personnel to-date is an overall reduction of 21 percent in fuel oil consumption at LEAD from FY 75 to FY 79, but only a 16% reduction from FY 75 to FY 82 (Figure 7).

2.3 Conclusions

Very few conclusions regarding potential candidates for ECIP projects can be made from this energy consumption data above. Those that can be made are as follows:

1. Building 350 is the single prime candidate for fuel oil energy savings. The fact that it utilizes the least



TOTAL FUEL OIL CONSUMPTION - 438,475* MBTU

LETTERKENNY ARMY DEPOT
FUEL OIL USE DISTRIBUTION BY
BOILER PLANTS - FY79

FIGURE NO. 6

*FY 82 Consumption 465,471

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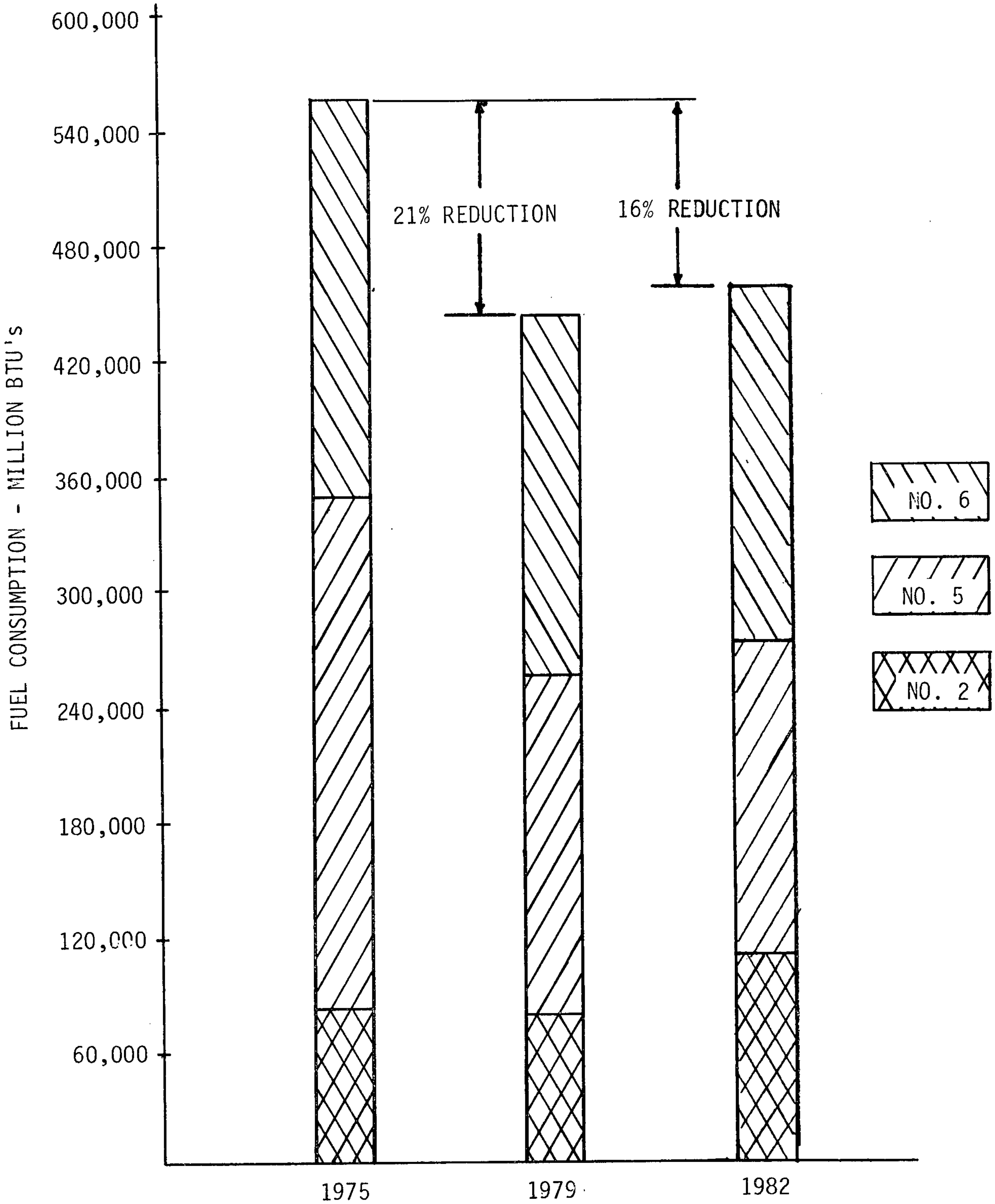

LETTERKENNY ARMY DEPOT

FUEL CONSUMPTION REDUCTION

FIGURE NO. 7

expensive of the three fuel oils used at LEAD will work against any potential ECIP projects.

2. The potential for building shell modifications is limited by the work already implemented by LEAD personnel. As such, further reduction in fuel consumption will have to come from reduction in loads associated with process requirements or from improvements in heating system efficiencies.

3. Electrical savings will primarily have to come from ECIP projects which involve electrical equipment or systems which operate essentially independent of the facility work schedule and thus contribute to the base electrical load. Lighting projects will be hampered by the limited hours of operation and the extremely low electric rates.

STUDY RESULTS

1. Field Surveys

Field surveys were conducted of the major buildings or groups of buildings included in the scope of work. The purpose of these surveys was to obtain data relative to the buildings' construction, occupancy, functional use, energy consumption, completed or programmed energy conservation or other modifications, and energy consuming equipment and systems. This data was then used to identify candidate ECIP projects and potential operating and maintenance improvements.

Building survey data are summarized in the Appendix to the Interim Report. Observations made during the field surveys are included as well as recommendations for energy savings. Where an ECIP analysis was made on a potential energy saving project, the results of that analysis are indicated. Other indicated recommendations for potential energy savings were considered operating and maintenance measures, or were capital improvements projects which were considered too small for qualification as ECIP projects. In a few cases, potential ECIP projects are identified but were not analyzed either due to unavailable drawings or data, or due to planned modifications to the building which would precluded ECIP analysis at this time.

2. ECIP Projects

2.1 Heat Recovery

One of the primary mechanisms whereby energy is lost from the maintenance process buildings at LEAD is through forced ventilation to remove hazardous or objectionable fumes, vapors or particulates which are generated by the activities being performed in the buildings. Some of these ventilation systems exhaust heated indoor

air directly to the atmosphere and, thereby, create a requirement to replace this air with an equal amount of outside air which must be heated up to the building temperature. Others of these systems return the air back to the building after removing the particulates in a baghouse, however, the baghouses are uninsulated and a significant amount of the heat in the air is rejected to the atmosphere. Because of the large number of such ventilation systems and the volume of air which they handle, a significant amount of effort was put into the analysis of methods to recover some of the energy presently being wasted by these systems.

Heat recovery from direct exhaust ventilation systems through the addition of heat exchangers was evaluated for the following ventilation systems:

Building 350 - Large Paint Booth Exhaust
Building 350 - Medium Paint Booth Exhaust
Building 350 - Small Parts Paint Booth Exhaust
Building 350 - North End Dip Tank Exhaust
Building 350 - South End Dip Tank Exhaust
Building 1 - Chrome Plating Exhaust Scrubber
Building 1 - Oil Dip and Chromic Acid Dip Tank Exhaust
Building 1 - Phosphatizing Dip Tank Exhaust
Building 1 - North End Paint Booth Exhaust
Building 37 - Paint Booths Exhaust
Building 57 - Vehicle Exhaust
Building 57 - Paint Booth Exhaust
Building 14 - Paint Booth Exhaust

Numerous qualifying ECIP projects resulted from the analysis of this type of modification. An additional ECIP project resulted from the evaluation of insulating the baghouses and duct work on the following ventilation systems:

Building 350 - Baghouse No. 2544
Building 350 - Baghouse No. 50
Building 350 - Baghouse No. 49
Building 37 - Baghouse No. LD 1294
Building 1 - Small and Large Baghouses

In addition to heat recovery from the ventilation systems, heat recovery from the engine test cells in Building No. 37 was evaluated as well.

The result of these analyses was to produce ECIP projects which will require a total capital investment of $758,465 and will produce annual fuel savings of 16,990 MBtu per year. The power requirements of the heat recovery fans will produce a total annual increase in electrical consumption of 2,365 MBtu. The net annual energy savings from these projects is therefore 14,625 MBtu.

2.2 Electrical

In an attempt to reverse the trend towards increased electrical consumption over the past few years at LEAD, a major emphasis was placed on the identification and analysis of ECIP projects which would produce electrical savings.

The first areas considered were those which contribute to the base electrical load. Two potential ECIP projects were identified in this area. The first involves installing air-to-chilled water precoolers on the air-conditioning systems for the computer facilities in Building Nos. 3 and 10. This project will cost $124,357 and produce an annual savings in electricity of 16,908 MBtu. The second project is the installation of vapor barriers on the interior of the dehumidified warehouses. These vapor barriers will reduce the moisture infiltration into these warehouses and thereby reduce the load on the electrically regenerated dessicant dehumidifiers.

The project will cost $806,347 and save 20,177 MBtu annually.

In an effort to further reduce electrical consumption, building lighting system replacement was evaluated for all of the maintenance and process buildings which appeared to be good candidates for new, energy efficient lighting systems. This list of good candidates included Building Nos. 1, 2, 4, 5, 8, 9, 19, 31, 32, 33, 34, 37, 41, 42, 43, 44, 47, 57, and 350. Buildings were grouped by similarities with the exception of Building 350, which was considered by itself. The evaluation produced only one qualifying ECIP project - the replacement of Building No. 350 incandescent and fluorescent general area lighting systems with high pressure sodium vapor lighting systems. This project will cost $237,464 and save 19,152 MBtu annually. The other lighting system replacement projects evaluated did not qualify as ECIP projects on the basis of unacceptable E/C ratios.

One other project that was evaluated despite its low cost was the installation of local lighting switches in Building No. 7 to allow selective switching. This project has excellent E/C and B/C ratios but is too small, $4,622 capital investment, to qualify as an ECIP by itself. It will, therefore, have to be grouped with another ECIP project or funded from some other program.

The total annual electrical savings resulting from the qualifying electrical ECIP projects is 67,821 MBtu (5,846,638 KWH). Part of this savings would be offset by the increased electrical consumption of heat recovery projects. The net annual electrical savings is therefore 65,456 MBtu or 5,642,759 KWH. This represents a 12.5% reduction in the present annual electrical consumption.

2.3 EMCS

The installation of various levels of EMCS was evaluated for LEAD and found to be unattractive economically. The primary reason for this result is that the major energy savings control scheme for

the LEAD buildings, namely, temperature setback during unoccupied hours, already has been implemented with local time clocks for many of the buildings. Remaining energy savings opportunities are not sufficient to justify the investment and maintenance expense associated with an EMCS.

An existing EMCS central unit is located in Building No. 663. It may be technically and economically feasible to utilize this device for additional building energy control functions. Cost of such expansion is not expected to be sufficient to qualify for ECIP funding.

2.4 Alternate Energy Sources

Solid waste energy recovery utilizing modular incinerators with heat recovery boilers was evaluated for LEAD. Building No. 349 was chosen as the only possible location for the incinerator since it is the only boiler plant with a year-round load. Unfortunately, the summer load is not high enough to utilize all the energy available from the waste produced by the Post. As such, the best alternative was an incinerator sized for the summer steam loads since it would have a higher annual load factor. This alternative produced a marginally acceptable E/C and B/C but an unacceptable payback period, primarily because of the high operating and maintenance costs and the fact that No. 6 fuel oil, the least expensive of the three fuels used at LEAD, is the fuel being saved.

Solar energy was not considered beyond a search for good candidate buildings for the application of solar hot water systems. Since there are not such individual buildings at LEAD, the evaluation of solar energy was deferred to Increment C of this Energy Engineering Analysis Program, where it will be evaluated for use in central systems.

The application of wood energy is being evaluated in Increment C as well. A central coal-fired plant is being evaluated under Increment E.

2.5 Building Shell Modification

As indicated previously, LEAD personnel have already implemented a comprehensive program of insulating walls and ceilings, reducing window areas, and installing storm windows. Thus, there remains only a limited number of good candidate buildings for shell modifications. The potential for qualifying shell projects is further limited by the fact that many of these remaining candidates have temperature setback controls, thus the energy supplied to the building has already been minimized. As a result, none of the shell projects evaluated produced acceptable E/C ratios.

2.6 Central Heating Plants

Inspection and testing of the central heating plants at LEAD revealed that almost all the boilers in these plants have very good efficiencies. Most of them were originally designed for coal-firing and were converted over to oil in the early seventies. The conversion package included installing air atomized burners with modulating controls in most cases. As such, they burn oil very efficiently.

The only central heating plant that has any boiler-related data metered and logged is Building No. 349. The only information available on the other plants is fuel deliveries. Thus there was no data on these other plants to develop daily load profiles, system efficiencies or seasonal efficiencies.

The data available from Building No. 349 produced calculated overall monthly system efficiencies (total steam/total fuel) from 56% to 94%. The accuracy of this data is therefore questionable.

The use of several alternative fuels for Building No. 349 either has been or is being evaluated as part of this study as was mentioned previously.

3. Summary of ECIP Projects

Table No. 1 which follows is a summary of the projects from Increments A, B, and G evaluated for LEAD. The projects are ranked in order of their E/C ratios. Under Increments A and B a total of eighteen projects were evaluated with nine of these meeting the ECIP requirements for E/C, B/C and payback.

The energy savings from these nine projects when combined with the energy savings already achieved by the Post as reflected in the FY 79 energy consumption, will produce a 15.3% energy use reduction compared to the consumption of FY 75.

The 1979 Energy Consumption (fuel oil and electricity) was 975 BBtu. The total ECIP Project savings (for qualifying projects) is 82.473 BBtu. This would result in a revised consumption of 892.527 BBtu if the projects are implemented.

4. Increment C - Alternate Energy Sources: Wood, Solar

Under Increment C of the Energy Engineering Analysis for Letterkenny Army Depot, the wood energy and solar energy options were studied as potential energy sources.

A. The wood energy study involved a look at the available wood resources in the vicinity of LEAD and the economics of two different size wood-fired steam plants at LEAD.

   The results of the study indicate that a wood-fired steam generating plant large enough to supply all of Building 349's steam requirements would most likely be feasible and that further investigation is warranted. For further details, see the Preliminary Feasibility Analysis: A Preliminary Investigation into a Wood-Fired Steam Generation Facility.

B. The solar energy study involved a look at the use of solar energy for the production of process steam as well as the production of domestic hot water. The process steam investigation was centered on Building 349 since it is the only facility on the base with a

LETTERKENNY ARMY DEPOT

PROJECT SUMMARY

INCREMENTS A, B & G

Inc-Rmt.	Proj. No.	Project Description	CWE ($)	B/C	E/C	Payback Period (Years)	Annual Energy Savings (MBtu)	Annual Dollar Savings ($)	Man-hours
		QUALIFYING PROJECTS:							
	G-L	Motorized Steam Valves 400-Series Bldgs.	11,515	79.2	345.0	0.3	3,973	38,379	20
	G-M	Installation of Local Switches in Building 7	5,010	29.8	330.0	0.6	1,655	8,936	85
	A/B-B	Air-to-Chilled Water Precooler for Computer Facilities in Bldgs. 3 & 10	124,357	5.3	136.0	3.28	16,908	37,874	1,173
	G-N	Warehouse Door Seals Bldg. No.s 2 & 4	52,732	21.2	92.4	1.1	4,875	47,093	244
	A/B-C	Replacement of Existing Bldg. 350 Incandescent and Flourescent General Area Lighting Systems with High Pressure Sodium Vapor Lighting Systems	237,464	5.5	80.7	2.6	19,152	89,765	3,524
	G-A	Sawdust Collector, Insulation & Air Return-Bldg. 350	7,300	6.9	31.0	3.5	227	2,115	99
	G-O	Boiler Economizers Bldg. No. 349	211,700	2.4	29.1	4.2	6,160	49,897	1,474
	A/B-D	Exhaust Heat Recovery - Buildings 37 & 350	153,041	5.2	26.6	4.6	4,036	33,264	1,724

QUALIFYING PROJECTS, CONTINUED

Inc-Rmt.	Proj. No.	Project Description	CWE ($)	B/C	E/C	Payback Period (Years)	Annual Energy Savings (MBtu)	Annual Dollar Savings ($)	Man-hours
	G-B	Lighting System Modifications - Bldgs 19, 37, 47 & 57	30,785	2.4	25.4	6.5	782	4,742	207
	A/B-E	Vapor Barrier for Dehum. Warehouses 11,18,31,32,34,41, 44,47,52,53,55,56	806,347	1.1	25.0	20.9	20,177	35,582	11,300
	A/B-G	Exhaust Heat Recovery, Bldg. 350 North End Dip Tank	221,737	3.0	20.4	8.2	4,526	27,126	1,929
	A/B-F	Exhaust Heat Recovery, Bldg. 1-Chrome Plate Exhaust Scrubber	126,408	3.5	17.1	7.0	2,166	18,002	866
	A/B-H	Baghouse Insulation and Air Return- 1, 37 & 350	133,686	2.4	15.4	10.0	2,036	13,407	2,412
	A/B-J	Supply/Exhaust Air Heat, Bldg. 350,Paint Booths No.s 59 and 60	124,593	2.26	14.9	10.1	1,861	12,313	602
	G-C	Lighting System Modifications - Bldgs 1,2,4,5,8&9	124,388	1.6	13.1	8.1	1,633	15,377	890
	G-D	Exhaust Heat Rec. Bldg. No. 350 , Med. Sized Paint Booth	162,211	3.0	12.6	8.1	2,056	20,223	1 559
	G-E	Exhaust Heat Rec. Bldg. No. 1 Paint Booth, North End of Building	59,142	2.9	12.3	8.4	729	7,015	393
	G-F	Exhaust Heat Rec. Bldg. No. 14 Paint Booth, East Side of Building	54,869	2.5	10.8	10.0	591	5,464	393
	G-G	Exhaust Heat Rec. Bldg. No. 37 Mid-Bldg Paint Booth-LEAD 468	54,869	2.5	10.7	10.1	588	5,430	393

QUALIFYING PROJECTS, CONTINUED

Inc-Rmt.	Proj. No.	Project Description	CWE ($)	B/C	E/C	Payback Period (Years)	Annual Energy Savings (MBtu)	Annual Dollar Savings ($)	Man-hours
	G-P	Warehouse Plastic-Strip Doors (Curtain Type) - Bldg No.s 2&4	32,806	2.3	10.2	10.2	336	3,246	120
	G-Q	Storm Windows Bldg No. 521	20,222	2.8	9.7	8.4	197	2,394	263
	G-R	Storm Windows Bldg. No. 663	31,118	2.2	9.6	10.7	300	2,898	405
	G-H	Window & Wall Insul. Bldg 400-Series 55^{0}F w/40^0 setb.	119,592	2.2	9.4	11.0	1,119	10,809	2,425
	G-S	Storm Windows Bldg No. 500	88,305	2.1	9.0	11.5	798	7,709	1,150
	G-T	Storm Windows Bldg No.s 4&2	19,713	2.0	8.7	11.9	171	1,651	257
	G-U	Storm Windows Bldg. No. 3	33,855	2.0	8.7	11.9	293	2,834	441
	G-V	Warehouse Dock Seals Bldg No. 2	44,822	1.98	8.6	12.0	387	3,738	179
SUBTOTAL			3,092,587	-	-	-	97,732	507,283	34,527

LETTERKENNY ARMY DEPOT - INCREMENTS A & B NON-QUALIFYING PROJECTS:

Inc-Rmt.	Proj. No.	Project Description	CWE ($)	B/C	E/C	Payback Period (Years)	Annual Energy Savings (MBtu)	Annual Dollar Savings ($)	Man-hours
	A/B-K	Installation of EMCS	25,193	0.81	71.25	-	1,795	(12,360)	405
	A/B-L	Heat Recovery Incineration	1,237,742	1.15	14.09	545	17,449	2,272	10,439
	A/B-J	Exhaust Heat Recovery, Bldg. 350-South End - Medium Sized Paint Booth*	150,563	2.0	13.7	12.7	2,056	11,832	1,302
	A/B-M	Recovery - Non-Qualifying Projects	Various	--	11.5-1.0	--	--	--	--

*Some qualifying projects are contained in these numbers

NON-QUALIFYING PROJECTS, INCREMENTS A & B

Inc-Rmt.	Proj. No.	Project Description	CWE ($)	B/C	E/C	Payback Period (Years)	Annual Energy Savings (MBtu)	Annual Dollar Savings ($)	Man-hours
	A/B-N	Window and Wall Insulation - 400 Series Bldgs.*	117,421	1.8	10.2	12.9	1,196	9,090	3,400
	A/B-O	Replacement of Existing Bldgs 1,2,3,4,5,8,&9 Incan.,Flour., & Mercury Vapor Lighting w/High Pressure Sodium Vapor Lighting	508,681	0.97	10.1	14.5	5,120	35,078	4,548
	A/B-P	Installation of Storm Windows in Building 663 *	28,489	1.84	10.0	12,8	300	2,219	667
	A/B-Q	Replacement of Existing Bldgs 19,37,47,&57 Incan.,Flour., & Mercury Vapor General Area Lighting w/High Pressure Sodium Vapor Lighting	342,732	0.7	8.3	23.1	2,849	14,855	2,519
	A/B-R	Replacement of Existing Bldgs 31,32,33,34,41, 42,43,&44 Flour. & Mercury Vapor Gen. Area Lighting w/High Pressure Sodium Vapor Lighting	474,942	0.2	3.7	118.9	1,754	3,995	6,334
SUBTOTALS:			2,885,763	-	-	-	32,519	66,981	29,614
		LETTERKENNY ARMY DEPOT - INCREMENT G NON-QUALIFYING PROJECTS:							
	G-I	Exhaust Heat Rec. Bldg. No. 350 South End-Dip Tnk	46,374	1.6	6.9	16.3	321	2,838	393
	G-J	Steam Supply Bldg. No. 320	1,036,699	1.2	1.5	17.7	1,596	58,515	9,022
	G-K	A/C System Mods Building No. 500	64,340	.03	.4	631.0	28	102	3,358
SUBTOTALS:			1,147,413	-	-	-	1,945	61,455	12,773
TOTALS:			7,125,763	-	-	-	132,196	635,719	76,914

* Some qualifying projects are contained in these numbers

significant year-round thermal demand for process steam. The domestic hot water investigation was concentrated on Buildings 600 through 608 in Kenny Gardens since these buildings involve the utilization of a central hot water system for space heating and domestic hot water.

The preliminary analysis shows a FY 1983 simple payback period of 24.4 years for the solar process steam application and a simple payback period of 13.6 years for the domestic hot water system. (See Preliminary Feasibility Analysis: Production of Process Steam and Domestic Hot Water Utilizing Solar Energy, for further details.)

5. Increment D - Cogeneration

Increment D of the Energy Engineering Analysis for Letterkenny involves the study of various methods of cogeneration for the purpose of finding a feasible method to reduce total source energy consumption.

The cogeneration systems studied were diesel engine, combustion gas turbine, and back-pressure steam turbine.

The back-pressure steam turbine system utilizing coal as fuel shows the most promise. This system represents a payback of 14.4 years. It appears that further study of this cogeneration system is warranted. (See Preliminary Feasibility Analysis: A Preliminary Investigation into the Feasibility of Various Methods of Cogeneration, for further details.)

6. Increment E - Central Coal-Fired Heating Plants

Increment E of the study for Letterkenny Army Depot covers the feasibility and most practical method of constructing a coal-fired

central boiler plant at LEAD. Several plant design options were considered. For these designs, different available fuels were also investigated.

The results of the study indicate the feasibility of implementing a new central coal-fired steam plant with boilers designed to accommodate the possible future use of supplemental fuels.

For further details see Increment E - Feasibility Study: Central Coal-Fired Heating Plants

7. Increment G - Projects Identified in Increments A & B That do not Meet ECIP Criteria

Identification of Increment G projects were accomplished during Phase I and II of Increments A and B. These projects are energy saving projects that do not qualify under ECIP criteria. There are 19 of the projects which are combined with those from Increments A & B and summarized in the table called Energy Conservation Project Summary.

The recommended projects represent an investment of $1,164,954 with an estimated annual savings of 26,870 MBtu.

8. Increment F - Facilities Engineer Conservation Measures

This phase of work provided for: (A) The development of recommendations for modifications and changes in the system operation which are written within the Facilities Engineer Funding Authority and Management Control, (B) The development of a prioritized summary of these energy conservation measures and projects, (C) The identification of energy related areas where Facilities Engineering personnel training is required and (D) The listing of energy related proposed changes in LEAD's Master Plan.

Fourteen modifications/changes in system operation were investigated and the results of these investigations are shown in a table called Project Summary, Increment F. Projects are prioritized by their SIR and grouped into the two categories of qualifying and non-qualifying. Qualifying projects are those which have a SIR greater than 1.0. Non-qualifying projects have a SIR less than 1.0. The SIR is based on a life which does not exceed the proposed equipment life, the facility's life, or 15 years, whichever is least.

Eleven courses for energy related training were identified and are listed in a table called Training Opportunities. The table lists the course type, cost and duration.

Three energy related chantes in LEAD's Master Plan were identified. The first is a new chrome plating facility. This change is expected to increase base consumption by 11385 MBtus per year. The second proposed change is a building addition to 370. This change is expected to increase base consumption by 31063 MBtus per year. The third proposed change is installation of a refuse incinerator with heat recovery. This change is expected to decrease base consumption by 16237 MBtus per year. The net effect of all these changes will be an increase in base consumption by 26,111 MBtus per year.

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LETTERKENNY ARMY DEPOT

PROJECT SUMMARY

INCREMENT F

FINAL SUBMITTAL

INCR./RMT. PROJ./NO.	DESCRIPTION	INVESTMENT ($ 82)	SIR	PAYBACK PERIOD (YRS)	ANNUAL ENERGY SAVINGS (MBtu)	ANNUAL DOLLAR SAVINGS ($ 82)
	QUALIFYING/RECOMMENDED PROJECTS					
F-J	Modifications to Existing EMCS Systems	29,534	28.2	0.6	14,702	51,104
F-F	Hot Water Heat Pump - Kenny Gardens 600,603	4,590	7.1	1.6	(-190)	2,827
F-6.3	High Eff. Shower Heads	1,417	5.8	1.9	225	737
F-6.2	High Efficiency Motors	56,175	2.5	4.4	3,901	12,780
F-A	Domestic Hot Water Heater Insulation	3445	1.5	7.5	248	461
F-E	Deisel Peaking Unit	99,635	1.5	7.5	2,194	13,352
F-B	Temperature Setback & A/C Shutdown in Bldgs. 2260, 412, 664, 227 and 431	37,104	1.3	10.7	847	3,484
F-8.1	Temporary Storm Windows Bldgs. 663 and 664	17,800	1.3	9.0	254	1,983
F-D	Ceiling Insulation Bldg. S-529	1,620	1.2	9.1	23	178
F-6.1	High Eff. Light Bulbs and Ballasts	92,736	1.2	3.9	7,250	23,751
	SUBTOTALS:	344,056	-	-	29,454	110,657

LETTERKENNY ARMY DEPOT, PROJECT SUMMARY
INCREMENT F, FINAL SUBMITTAL, CONT'D.

NON-QUALIFYING/NOT RECOMMENDED PROJECTS

F-I	Reduction of Infiltration in Roll-up Doors, Bldg. 320	36,301	0.8	5.3	966	6,822
F-C	Reduction of Infiltration in Roll-up Doors, Bldg. 37	31,545	0.7	7.8	840	3,987
F-G	Reduction of Infiltration in Roll-up Doors, Bldg. 57	28,410	0.7	7.9	756	3,589
F-H	Reduction of Infiltration in Roll-up Doors, Bldg. 350	37,578	0.5	10.1	1,000	3,712
	SUBTOTALS:	133,834	-	-	3,562	18,110
	TOTALS:	477,890	-	-	33,016	128,767

TRAINING OPPORTUNITIES

	COURSE DESCRIPTION	DURATION	COST
1.	Energy Conservation Awareness Seminar	4 - 3½ hr. Sessions	Varies Per Post
2.	Energy Conservation for Existing Buildings	40 hrs.	$ 580
3.	Energy Conservation for New Buildings	40 hrs.	$ 660
4.	Economic Analysis of Energy Systems	40 hrs.	$ 660
5.	Centrifugal Chiller Owner's Training Program	16 hrs.	$ 180
6.	Refrigeration and Air Conditioning Inspection	40 hrs.	$ 825
7.	Cleaver Brooks Boiler Operators School	16 hrs.	$ 0
8.	Fundamentals of Delta 1000 Operation and Standard CPU Programming	28 hrs.	$ 900
9.	Advanced Energy Management Programming	28 hrs.	$1,125
10.	Energy Monitoring and Control Systems Operator Training	40 hrs.	$ 450
11.	Energy Monitoring and Control System Inspection	40 hrs.	$ 425